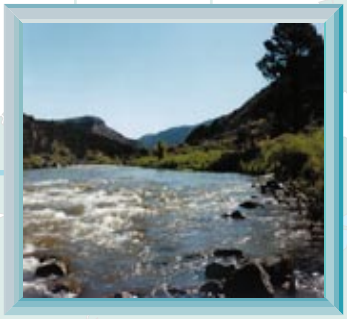
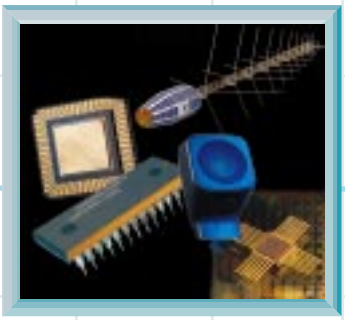


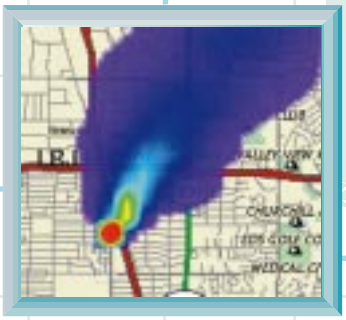
Water Systems

Energy

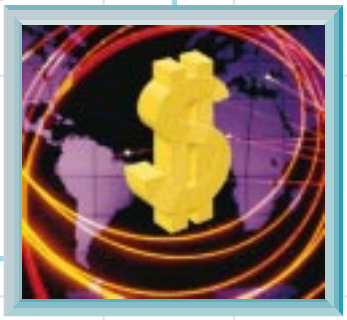
Transportation



Information and Telecommunication



Emergency Services



Banking and Finance

Los Alamos

# Critical Infrastructure Assurance Program

*a multidivisional program to protect the Nation's critical infrastructures*

LOS ALAMOS NATIONAL LABORATORY

**Our nation's infrastructures are the interdependent networks and systems that provide a continual flow of goods and services essential to our defense and economic security—in short, our industrial and technological base. Protecting our infrastructures is a critical national issue.**

The message in Presidential Decision Directive (PDD) 63, dated May 22, 1998, is clear.

> *"The United States possesses both the world's strongest military and its largest national economy. Those two aspects of our power are mutually reinforc and dependent. They are also increasingly reliant upon certain critical infrastructures and upon cyber-based information systems."*

Because of this increasing reliance upon these critical infrastructures,

> *"nontraditional attacks on our infrastructure and information systems n be capable of significantly harming both our military power and our economy."*

Vulnerabilities include

> *"equipment failures, human error, weather and other natural causes, and physical and cyber attacks."*

Having recognized that vulnerabilities to our military power and national economy are threats to our national security, the executive branch (under PDD-63) is organizing to address the problem.

As one of the largest multi-program laboratories in the world, Los Alamos National Laboratory is responsible for developing and implementing science- and technology-based solutions to problems of national and international importance. The Laboratory tackles those problems which, because of their complexity, size, and multi-disciplinary attributes, or associations with national security needs, fall beyond the purview of other organizations. Further, the solutions to many of these complex problems require computational capabilities that are unique to Los Alamos.

Los Alamos National Laboratory

***The Critical Infrastructure Assurance Program is an excellent example of "Science Serving Society."***

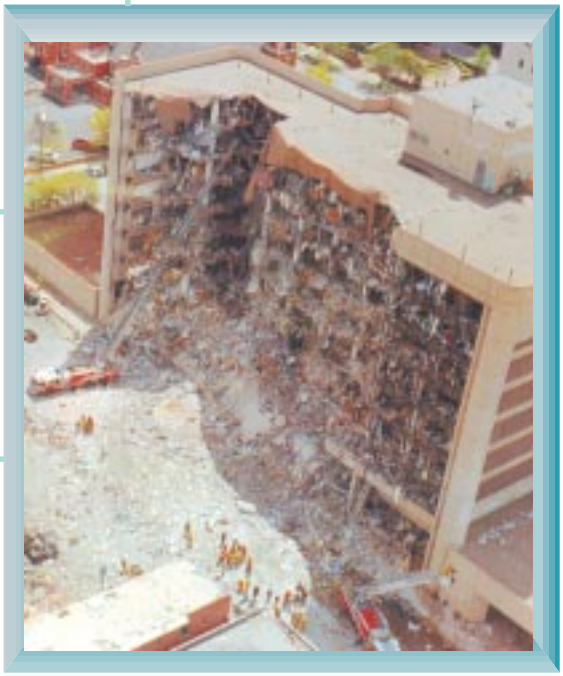
## Los Alamos – Critical Infrastructure Assurance Program

### *Goal – Infrastructure Security and Reliability*

Quality of life in the United States relies, in large measure, on the continuous operations of a complex infrastructure which consists of many subsystems—energy, transportation, water, telecommunications, banking and finance, law enforcement, government, and others. Linked together through a vast cyber network, these subsystems have become completely interdependent. Disruptions in any one of them could jeopardize the continued operation of the entire infrastructure.

This infrastructure system-of-systems faces a number of potential vulnerabilities:

- Physical threats
  - terrorists
  - natural disasters
  - aging and degradation
- Cyber threats
  - malicious intrusion
  - insider threat
  - inadvertent error
- System complexity
  - deregulation
  - automation
  - increasing interdependencies



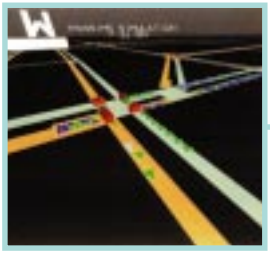
AP/Wide World Photo

### *Approach – Application of Los Alamos Capabilities*

Los Alamos National Laboratory is helping several U. S. agencies to address infrastructure vulnerabilities through well-developed programs that draw from the Laboratory's core competencies in advanced computer simulations, analysis and assessment, nonproliferation and national security, and environmental safety and health. These programs have developed technologies that can predict infrastructure vulnerabilities under various scenarios, prevent damage from occurring, mitigate/minimize it when it does occur, and restore system integrity as soon as possible. The Critical Infrastructure Assurance Program (CIAP) coordinates Laboratory efforts in this area and serves as the focal point for collaborations with industry, universities, and other government agencies who can help develop and implement infrastructure solutions.

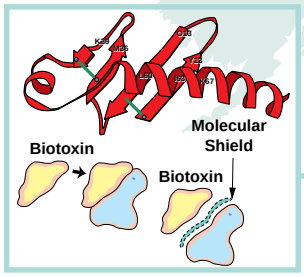
## Examples of Los Alamos Critical Infrastructure-Related Programs

- **TRANSIMS–Transportation Simulation**
  A complex computer simulation of urban transportation at a regional scale that is resolved to the level of individual travel entities—people, vehicles, and goods—on the transportation network.

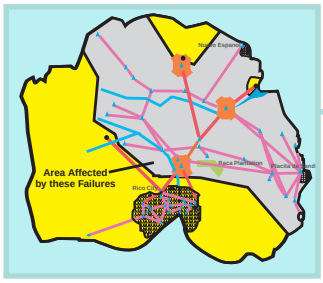


- **NTSim–National Transportation Simulation**
  A complex computer simulation of multimodal transportation at the national level. Transportation modes include trains, trucks, and planes.

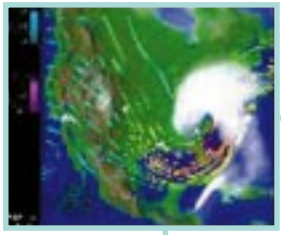
- **Chem/Bio Programs**
  Designed to counter the threat to our infrastructure from the proliferation of chemical and biological weapons of mass destruction by integrating the physical and life sciences with system engineering and arms control and nonproliferation regimes.

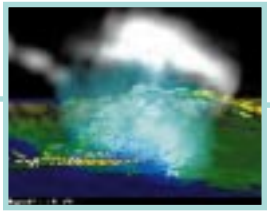



- **Infrastructure Assurance Analysis Program**
  Models energy infrastructures such as electric power, oil, and natural gas and evaluates the potential impact of their disruption on U. S. military operations.



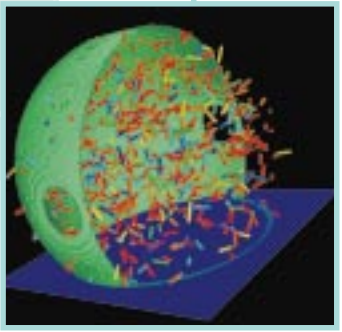

- **Global Climate Modeling**
  Computational models to help understand the processes that control the Earth's climate and predict conditions such as weather and natural disasters which can impact infrastructures.






- **Manufacturing Industry Modeling**
  Detailed simulations of various segments of our nation's manufacturing infrastructure. The types of simulations vary widely—from plutonium pit production to textile production.

- **Cyber Security**
  A collection of programs and technologies to protect computers and their information. Projects include techniques for secure information exchange and various types of computer detection techniques.



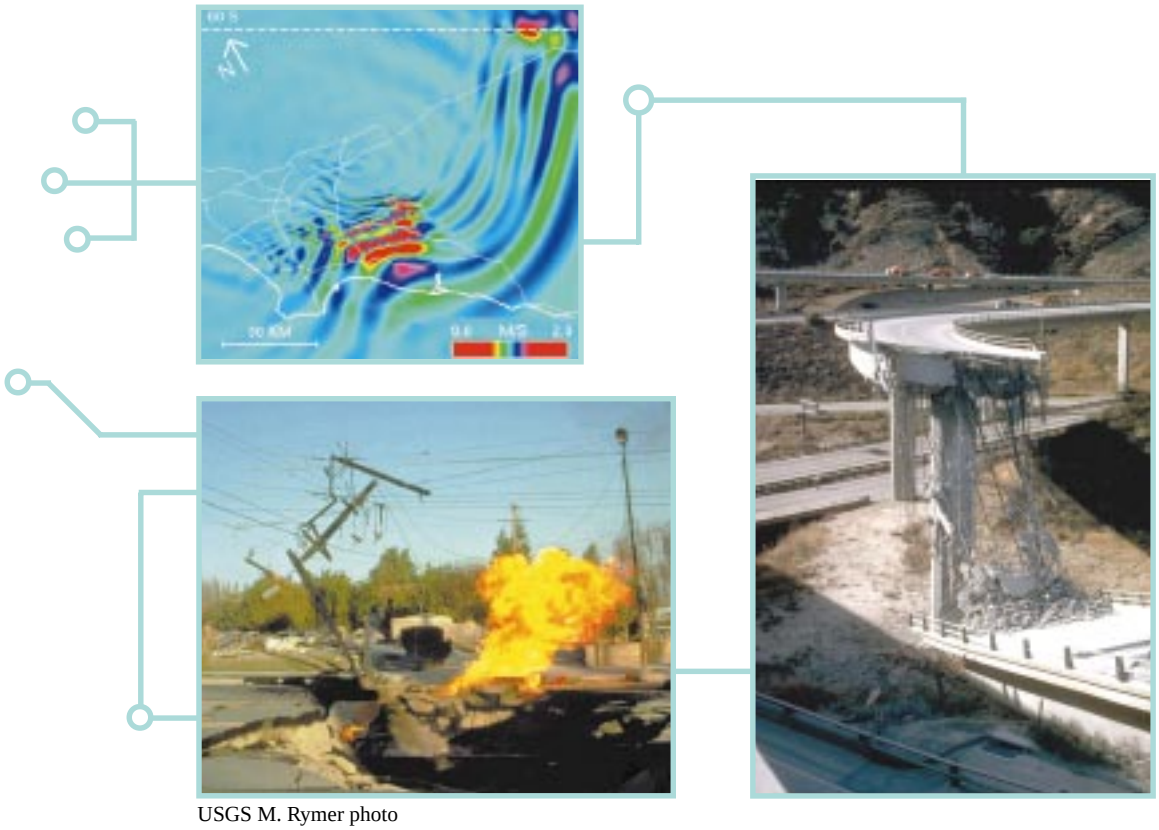
- **Advanced Simulation**
  Los Alamos is developing a science-based integrated "system-of-systems" simulation and database capability for the nation's infrastructure. This capability will allow the Laboratory to model the interdependencies of the various infrastructures rather than the conventional approach of evaluating each infrastructure separately. The Laboratory is also developing a comprehensive simulation of the electric power infrastructure designed to study important emergent effects in this industry.


- **Urban Security**
  A cross-divisional, complex systems competency to assess the response of urban infrastructure to changes in the physical environment ranging from malicious attacks to natural hazards.

## Integration — Infrastructure as a System of Complex Systems

Though the United States' infrastructures are tightly linked and interdependent, they are analyzed today as separate, stand-alone entities largely because tools and computational capabilities do not exist to allow a "holistic" analytic approach. Los Alamos' Critical Infrastructure Assurance Program addresses the need for a comprehensive capability to assess the national infrastructure as a system of complex, interconnected, nonlinear systems with spatial and temporal characteristics.

Subtle interactions with feedback and feed-forward loops often exist in complex systems such as these critical infrastructures. One example is a failure of an electric power substation that causes a topological reconfiguration of the electric network, which in turn overloads another substation in the local grid if the demand at that time exceeds the substation's capacity. Another example is a failure or interaction that occurs over an extended period which allows an imperceptible propagation (cascading) through the infrastructure elements such as cyber attacks on the banking and finance infrastructure. This program develops the simulation and computational capabilities to address these complex interactions.



USGS M. Rymer photo

*A natural disaster such as an earthquake requires, at a minimum, simultaneous consideration of transportation, the electrical power grid, and telecommunications. The capability to view the entire national infrastructure as a "system of interrelated systems" has never existed, yet more than ever it is needed in order to conduct contingency analyses, vulnerability studies, and investment options assessments.*

## Joining Forces to Protect Critical Resources

Because infrastructure subsystems are so interdependent, no agency or corporation can address potential threats alone. For that reason, one of CIAP's major responsibilities is to encourage and facilitate partnerships among national laboratories, industry, universities, and government agencies. Los Alamos cannot employ its vast array of analytical tools without the cooperation of those who own and operate the many subsystems. Complex problems require complex solutions that are best arrived at when all stakeholders pool their resources. Los Alamos' Critical Infrastructure Assurance Program provides mechanisms for such collaborations.

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